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TITLE OF THESIS..... WHICH STATIC MODES OF VISUAL REPRESENTATION MOST AFFECT COMPREHENSION OF IMAGE CONCEPTS .....

UNIVERSITY..... OF ALBERTA .....

DEGREE FOR WHICH THESIS WAS PRESENTED..... MASTER OF VISUAL ARTS

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Final Visual Presentation
for the degree of
Master of Visual Arts

Visual
Communication Design

Sally Don

1976

UOA

The University of Alberta

Which static modes of visual representation most affect comprehension of image concepts

by

Sally Don

A Thesis
submitted to
The Faculty of Graduate Studies and Research
in partial fulfillment
of the requirements
for the degree
of Master of Visual Arts
in
Visual Communication Design

Department of Art and Design

Edmonton, Alberta
Spring 1976

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submitted by .....Sally Don.....

in partial fulfilment of the requirements for the degree of Master of Visual Arts.

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Which static modes of visual representation most affect comprehension of image concepts

Working hypothesis

That static modes of visual representation affect comprehension of image concepts.

Long term aims

To provide an objective basis for the design of printed educational materials by showing relationships between theories of communication, concept formation and perception.

Specific objectives

This thesis is concerned with the design of a test to examine the effect of seven defined modes of visual representation on comprehension of concepts; i.e.

1. To produce ten sets of images representing ten image concepts chosen from 'A Visual Syntax' which is part of the thesis 'An Introduction to Graphic Communication', compiled by Greg Prygrocki.

2. Each set of images to consist of the same seven defined modes of visual representation, which are seven frequently used in printing educational materials.

3. Each mode of visual representation to be reproducible by mass printing processes.

4. The treatment of information in seven modes of visual representation to be kept to a consistent quality.

5. To find a basis for rating comprehension of image concept rather than personal preference for any particular mode.

6. To devise appropriate procedures to test the above.

The mode of action by which a design fulfills its purpose is in its function. Aesthetic value is an inherent part of function. Much recent design has satisfied only evanescent wants and desires, while the genuine needs of man have often been neglected by the designer.

Design must become an innovative, creative, cross disciplinary tool, responsive to the true needs of men. It must be more research oriented and we must stop defiling the earth with poorly designed objects and structures. (Victor Papanek)

Papanek, V.
Design for the real world
p.5

Up to the present time, the majority of designers have based their work on traditional, fashionable or intuitive criteria. After the turn of the century, graphic design evolved from the fine arts, poster design, photography and typography. It was mainly addressed to the consumer and design expertise was most fully involved in industry and advertising.

With the introduction of communication theory, the emphasis in graphic design activity has partially moved from persuasion to information. In addition, psychologists have demonstrated similarities in theories of communication, concept formation and perception.

Because of this awareness, the area of graphic design, renamed visual communication design, has been widened to include the publication of materials for education.

Definitions in italics are taken from other sources. (d) denotes a definition taken from Webster's New Collegiate Dictionary.
My definition used in this thesis is set below in roman.

to abstract — *(d) To draw away, dissassociate from an instance.*
To reduce to intrinsic form.

abstraction — *(d) The act of making something have intrinsic form.*
In this thesis, abstraction may be used as the reduction of information to essential defining attributes.

abstract image — A coherent configuration of intrinsic or essential attributes.

affective category — See category.

analogy — *(d) Resemblance in some particulars between things otherwise unlike.*

attribute — An inherent characteristic or discriminable feature of an event.

- defining attribute — One of a number of inherent characteristics or discriminable features of an event which make up an event or piece of information.
- variable attribute — An inherent characteristic or discriminable feature of an event that may vary from event to event.
- criterial attribute — An essential characteristic or discriminable feature which, when changed in value, alters the likelihood of an event being categorized in a certain way.
- critical attribute — An essential characteristic or discriminable feature whose absence alters the likelihood of an event being categorized in a certain way.
- scale of values of an attribute — Scale through which an attribute may vary from event to event.
- visual attribute — A discriminable pictorial feature of an image concept.

category — *(d) A division within a system of classification.*
In this thesis, used mainly as a category in concept formation.

- affective category — *In concept formation, things are grouped or placed in an affective category because they cause the same disposition to occur in the respondent.*
This category may not therefore be easily described in terms of any of the properties of objects comprising them. (Bruner)
Bruner, J.S.
A Study of Thinking p.140

functional category	*In concept formation things are grouped or placed in this category because of an external function. The objects of a functional category fulfill a concrete and specific task requirement. (Bruner)*
formal category	*In concept formation things are grouped or placed in this category because of the essential form of their attribute properties. (Bruner)*
channel	*A channel is the physical means of communication. (Shannon & Weaver)*
code	*(d) A system of signals or symbols for communication used to represent meanings.* A code is a system or structure imposed upon information which permits information to be transmitted. The manner in which a statement is codified or represented determines the form of the information.
encode	Process by which certain signals are selected and put into a channel according to a system.
decoding	Process by which certain signals are identified and referred to the system.
cognition	*(d) The act or process of knowing.*
cognitive	*(d) Capable of being reduced to factual knowledge.*
cognitive representation	Bringing before the mind for the act or process of knowing.
cognitive purpose	Purpose of learning, knowing, becoming aware.
concept	*A mode of ordering sensory data. (Bruner)* A set of ideas, generally applied to particular instances.
image concept	In this thesis, a concept related to a coherent configuration of visual elements.
criterial attribute	See attribute.
critical attribute	See attribute.

Bruner, J.S.
A Study of Thinking p.139

Shannon and Weaver
The Mathematical Theory of Communication p.7

to define	Determine the essential qualities and outer limits of something.
defining attribute	See attribute.
diagram	A two dimensional linear configuration explaining relations between elements.
form	The shape of something distinguished from its material.
visual form	The perceptual carrier of visual meaning.
intrinsic form	*(d) Belonging to the essential nature or constitution of a thing.* In this thesis, used mainly to imply meaningful shape.
fidelity	*(d) Faithfulness to something through appropriate correspondence.* In this thesis, used to imply the degree of accuracy of visual representation to a referent.
relational fidelity	Fidelity in visual representation shown through structural correspondence of visual information.
point to point fidelity	Fidelity is shown through accurate point to point correspondence.
functional category	See category.
formal category	See category.
hypothesis	*(d) A tentative assumption made in order to draw out and test its consequences: an interpretation of a situation or condition taken as ground for action.*
perceptual hypothesis	A perceptual formulation of an idea or principle based on inference from observed data.
iconic representation	A conventional, simple representation whose reference to an original is or seems familiar. A traditional representation, associated with a subject through understanding.
idea	*(d) Transcendent entity that is a real pattern of which existing things are imperfect representations.* In this thesis, used to mean something that exists in the mind as a formulation of something seen, known and imagined.

image	In this thesis, used in a pictorial sense to imply a coherent configuration of visual elements.
image concept	In this thesis, a concept related to a coherent configuration of visual elements.
pictorial concept	Concept relating to the making of a two dimensional statement of visual qualities contained within a defined area.
information	Items of knowledge.
visual information	Items of knowledge represented in visual terms.
written information	Items of knowledge represented in written terms.
information theory	*(d) A theory that deals statistically with information; the measurement of its content in terms of its essential characteristics.*
to internalize	Incorporate information within the self as conscious or subconscious guiding principles through learning.
intrinsic form	See form.
mnemonic	Assisting or intended to assist memory.
medium **media**	*In information theory, the channel and code together comprise the medium which is the total means of transmission of information (Shannon & Weaver)*
mode	In this thesis, the term mode is meant as the application of visible material of a configuration to a surface.
noise	*(d) Any sound that is undesired or interferes with one's hearing of something is an unwanted signal or disturbance.* *In information theory, noise is whatever increases uncertainty and interferes with the message. (Shannon & Weaver)* *In concept formation, a noisy attribute is a whole attribute whose presence delays the discovery of a set of defining attributes. (Bruner)*
visual noise	An attribute whose presence disturbs the recognition of the structural information of the concept.

Bruner, J.S.
A Study of Thinking p.136

Shannon and Weaver
The Mathematical Theory of Communication p.6

pattern	*(d) Form proposed for imitation.* In this thesis, used to imply a form comprised of repeated elements.
perceptual hypothesis	See perception.
picture	A two dimensional statement of visual qualities contained within a defined area.
pictorial	*(d) Relating to the painting or drawing of pictures.* In this thesis, relating to the term defined under picture.
phoneme	A number of the set of the smallest units of speech that serve to distinguish one utterance from another in a language or dialect.
point to point fidelity	See fidelity.
property	*(d) Quality of an individual or thing.*
cognitive purpose	Purpose of learning, knowing, becoming aware.
realistic (realism)	Not illusory, relating most objectively and directly to a referent.
visual realism	Visual configuration relating most objectively and directly to a referent.
written realism	Written description relating most objectively and directly to a referent.
referent	*(d) One that is referred to.*
representation	Way of bringing information before the mind via media.
mode of visual representation	Visual way of bringing information before the mind via media (see page 20) In this thesis, the term mode is meant as the application of visible material in a configuration to a surface.
iconic representation	See iconic
cognitive representation	See cognitive.

redundancy — Used in this thesis to mean that part of a message that can be eliminated without loss of essential information.

recessive — *(d) Withdrawn.*
Used in this thesis to describe information that needs to be brought out (for example, the line image of the greenhouse brings out the plants more clearly than the photograph).

relational fidelity — See fidelity.

sample space — *An area or situation in which some event is to be selected from a set of alternative events. (Shannon & Weaver)*

schema — A defined arrangement of elements for a purpose.

schematic diagram — A two dimensional configuration of elements that explains rather than represents.

schematic image — A coherent arrangement of the essential intrinsic attributes of a class of things.

schematic memory — A memory which purposefully recalls defined arrangements of elements.

sign — A visual stimulus, standing for a stimulus not present in the perceptual field of the observer (for example, the line image of the face).

signal — *(d) Something that incites to action; something made to give warning or command.*

spectral — *(d) Relating to the color spectrum.*

stimulus — *(d) Something that rouses or incites to activity.*
Used in this thesis to imply something that causes a physiological affect and acts as an agent in the communication process.

visual stimulus — Something that effects perception by sight.

structure — Intrinsic pattern of supporting elements and tensions relating to form.

structural information of an image concept	Visual elements forming an essential definable configuration.
surrogate	*Something that serves as a substitute. (Gibson)*
symbol	Something that stands for or suggests something else by reason of a relationship, association, convention, or resemblance.
system	An interacting group of items forming a unified whole.
visible	Capable of being seen.
visual	Relating to perception by sight.

Gibson, J.J.
A Theory of Pictorial Perception

1. The general idea for this thesis in September 1974 was to write and design a Visual Communication unit of self instruction consisting of a workbook for use with audiotape which was to be used as part of the communications course at Athabasca University. In outline this was to involve research within the field of Visual Communication to discover certain concepts which were to be applied to a form suitable for teaching. This proposal was to cover a wide range of related ideas.

The difficulty was that there were too many possibilities for the time available. It was first necessary to reduce the number of possibilities.

2. The next idea was to examine the effect of various qualities of diagrammatic representation used in printed educational materials, in order to propose optimum ways of presenting information. This was to involve the investigation of forms of presentation which varied from schematic to realistic, to discover which forms are most appropriate for comprehension, in what circumstances. The media outlined for consideration were color, photography and illustration. In addition this study was to include the examination of pages of a workbook.

This proposal was too complex and needed to be simplified.

3. In August 1975, I began to define more closely the limits of the thesis. In the area of self instruction, I considered some of the media that are available as forms of presentation, in particular the workbook for use in conjunction with audiotape; videotape, slide presentation, film, wallcharts, packaged material. As a basis for consideration of any of these media, information was to be divided into groups in some form of coherent sequence. As information content, I would have chosen Soil Forming processes which had previously been presented in a unit of self instruction at Athabasca University.

a. In order to examine the function of the workbook, a possibility was to consider the percentage of typographic to photographic or illustrative material, and the relationship of typography to illustrations. One way of comparing effects would be to present to one group of subjects four pieces of information of equal level of difficulty in four different forms. A second way would be to present to four groups, the same piece of information in four forms. In each case the information would be coded by illustrations with accompanying explanatory text.

b. Another possibility would be to evaluate illustrations directly against accompanying explanatory text.

My own knowledge of the content I had chosen was limited and I had no access to soil materials to illustrate. In both a and b, it also seemed difficult to tell whether comprehension would be due to the illustrations or the text. A better way had to be found to test one form of presentation at a time.

4. The fourth idea was to examine how information may be coded in images. I tried to find a way to classify images and primarily divided these into photographs and line or schematic drawings.

I further examined ways of using symbolic, iconic and abstract images to represent information. If these terms are used as categories, there is an apparent difficulty of classifying images into these categories. An image may function in a number of ways, depending on its context. It is possible to assign an image to either a single category and/or all three categories.

These categories do not help to understand the function of a specific image nor explain the concept which it represents. They are therefore not a suitable basis from which to test comprehension.

5. The final idea was to design a test to examine the effect on comprehension of defined modes of visual representation which are frequently used in printing.

At first there seemed eight possible modes of visual representation to consider; these were eventually reduced to seven (see problems, page 11)

In order to design a test of these seven modes,(see page 20) I chose to use content with which I was familiar, taken from 'A Visual Syntax' part of the thesis 'An Introduction to Graphic Communication', compiled by Greg Prygrocki (see page 46)

The content was already in a coherent sequence. By dividing the copy into passages, an image concept could be derived from each passage. I used 10 image concepts.

Each image concept is represented in seven defined modes of visual representation. Altogether there are 84 images, since two image concepts are each represented in two alternative versions.

The purpose of the test is to discover which modes of visual representation are best for comprehension.

1. Problems with images

It took five months to design and produce all 10 sets of images representing 10 image concepts. The major problem was to keep the treatment of information in the images to a consistent quality within each set and from mode to mode, whilst altering the subjects of the images to represent most appropriately the image concepts.

In general, the photographs are of a higher quality than the drawings; the tone drawings are in some cases more nearly copies of the photographs than representative of the essential configuration of visual elements of the image concepts.

It can be seen that the quality of illustration is uneven. For example, the tint representations of 'comparison of size' could have been improved. If these are compared with the tint images of 'movement', there is an obvious difference in quality.

The size and format of each image was originally chosen to be used in a tachistoscopic presentation. In some cases, the square format of the image presented a problem, if the subject chosen would have better fitted a rectangular format (see movement, page 26)

2. Problems with modes of visual representation

It seemed important to test modes of representation that are frequently used in printing educational materials (see page 20)

I chose to exclude color tone drawings, because they might too closely resemble color photographs.

The two color line and tint images could have consisted of many different colors. I chose to use only two colors because two colors are frequently used in printing for the sake of economy.

3. Problems with image concept titles

Image concept titles are derived from the passages from 'A Visual Syntax' (see page 46) In some cases the title of the concept was obvious; in others the passage had to be interpreted more carefully to find the appropriate image concept title.(see Attraction, page 47)

Example: Image concept title: Open structure

Original passage from which title is derived:

> *Overall structural features are the primary data of perception. 'Chairness' is not a concept resulting from intellectual abstraction, but is the direct result of a more fundamental perceptual experience than the recording of individual details. Thus all the variety and styles of chairs are recognized as such because they all have the underlying structural features of a 'chair'.*
> *A child will see a chair before he can recognize it as a particular style of chair distinguishable from others.*

The first title derived from this passage would have been 'chair'. This was also the subject of the image. I changed the image concept title to 'open structure' and the written description so that both would refer to the configuration of visual elements of the image concept, or what the image structurally represents.

4. Problems with image subjects

Each image concept is represented by a realistic subject.
Since the test is concerned with comprehension of concepts and not personal preference of mode, it is important that the image concept rather than the subject o f the image is recognized from the image. The subject of the image must correspond with the image concept, but it is not the concept itself.

In each image, the major difficulty was to find a 'realistic' subject that fitted the image concept, to show clearly the essential configuration of visual elements.

Example: Movement

I first attempted to use a photograph of a racing car to represent this concept. It did not show either the car or the motion clearly enough.

My second attempts were of a bicycle moving and children walking. In all of these I had problems because I focussed on the moving object, or took the photograph at too fast a shutter speed, against the wrong background.

The result was a blurred photograph which did not show either the subject or the image concept clearly enough.

The final image of a car shows the horizontal blur against static vertical background elements.

5. Problem with written description of image concept

Each image concept is represented by a written description. In the test, the written description must act as a cue to recognizing the essential configuration of visual elements without describing too closely the subject of the image.

In the second pretest, some of the early written descriptions of the image concepts were confused with each other (see page 33)

Example: Image concept title: Greenhouse

> *A three dimensional arrangement of elements forming an external structure through which internal elements can be seen.*

Example: Image concept title: Chair

> *An arrangement of four elements in a vertical plane and three in a horizontal plane. The largest horizontal element creates a flat surface area between the four vertical elements.*

These were changed to :

> *An arrangement of shapes showing a three dimensional external structure through which interior elements of a different nature can be seen*

and

> *A functional construction of four bars in a vertical position and two bars and one flat surface in a horizontal position*

The major difficulty was to describe each image concept accurately enough to fit one concept only, but to leave some doubt as inducement for search. In the test, if the concept is immediately recognized, no comparison would be made, and no rank order established.

Example: Image concept title: Open structure

The final description refers to the concept of an image of a chair, or what the image structurally represents. Over the time of the design of the image concept, the description changed as follows:

1. 'A three dimensional arrangement of elements in a definite pattern of organization which is not enclosed or confined and is accessible on nearly all sides'

2. 'A construction of four bars in a vertical position and two bars and one flat surface in a horizontal position'

3. 'A functional construction of four bars in a vertical position and two bars and one flat surface in a horizontal position'

All of the written descriptions underwent similar changes.

6. Problem with critical attribute

Each image concept is composed of a set of defining attributes which appear visually in the image and in the written description of the image concept.

Each image concept has one critical attribute without which the image concept may not be apparent. It was important to find the critical attribute in order to design each one of the images and in order to compose an appropriate written description.

Example: Image concept title: Comparison of size

The first image showed one moth at two different degrees of enlargement on a flat background. From the wing patterns it was apparently the same moth; the size comparison depends upon two dissimilar subjects being juxtaposed , one of which must have convincing size properties in order to reflect the approximate size of the shape with which it is juxtaposed.

7. Problem of design of test

It is important to find a basis for rating comprehension of image concept rather than personal preference for any particular mode. However, there are several possible ways of testing 84 images, which I considered for different purposes.

1. Test for memory
A group of images is presented to a subject by a tachistoscope in a random sequence. Each image is shown for a short time period. After looking at all of the images, the subject is asked to recall the images he best remembers. This is a test of recognition and memory and provokes the question of how long an image should be displayed for adequate reading. This is not a test for comprehension, although recognition and memory are important features of comprehension.

2. Test for recognition of image attributes
A group of images is presented to a subject by a tachistoscope in a random sequence. Each image is shown for a short time period. After looking at each image, the subject is asked a question about some of the visual attributes contained in the image (what did you see, how many were there). The number of correct answers is scored. This again is for memory and recognition and not comprehension.

Pretests

1. Test for preference of mode of representation
All the images are grouped by concept and displayed in an open presentation on a wall or walls. Subjects may have as long as they like to look at all the images. This most closely resembles the presentation of information in book form.
On a score sheet, subjects are given the name of the concept, a verbal description and are asked to rank order the seven modes of presentation and give a reason for their first choice.

A preference test may be useful for discovering visual preference for modes of representation. It does not however give an indication of comprehension of these modes.

2. Test for comprehension of mode of representation
Images are grouped by mode of visual representation. Subjects are asked to match an image to a description of a concept, choosing one description out of four. One subject sees one mode of all concepts. Seven groups of subjects are required. Comparison is made between the scores received for mode of visual representation.

3. Test for comprehension of mode of representation.
Images are placed in a random sequence on a wall or walls. In the first version, subjects are given all the descriptions for each image and are asked to score each description for how well it matches the concept. This provides not only a rank ordering of all the images, but also a measure of how well the descriptions match the concepts. This test however was altered, since in practice most of the subjects found it far too long, and those who actually reached the end had lost concentration on the images and descriptions.

The alternatives were either to reduce the number of images given in the test, or to reduce the number of decisions that the subjects were asked to make.

Final test of series

The test was changed to the final version in which all 84 images are used and the subjects are to be asked to score the three top descriptions out of ten descriptions. Statistically, this makes a positive result more likely since the top part of the scale of results is scored over a wide number of images and the lower end of the scale of results is ignored.

The descriptions were also changed in the final version to make them closer to the essential configuration of visual elements of the image concept.

1. The image
2. Mode of visual representation
3. Image concept title
4. Image subject
5. Written description of image concept
6. Critical attribute of image concept
7. Category

1. Each image represents one image concept

2. Each image is a constant of the essential configuration of a set.

3. Each image is a variable of a mode of visual representation

4. Within each image the treatment of information to be kept to a consistent quality within a set of images and within the whole group of concepts.

5. Each image measures 7½ x 7½ inches, square format.

6. Each image is carried out on illustration board 10 x 11 inches and is in the same position.

7. Each image is numbered in the top left hand corner.

2a. List of modes of visual representation

1. Black and white continuous tone photographs
2. Full color continuous tone photographs
3. Black and white tone drawings
4. Black and white tint images
5. Two color tint images
6. Black and white line images
7. Two color line images

In this thesis, the term mode is meant as the application of material in a configuration to a surface.

1. Black and white continuous tone photographs
An image taken through a camera lens showing a direct point-to-point proportional, structural, tonal black and white relationship with the image concept.

2. Full color continuous tone photographs
An image taken through a camera lens showing a direct point-to-point proportional, structural, tonal and spectral relationship with the image concept.

3. Black and white tone drawings
Application of black graphic pigments (particles) in areas of various densities to white surface to show most appropriately the visual form of the image concept, including tonal components.

4. Black and white tint images
Areas of uniformly flat densities of black pigment in percentages chosen from 0%, 10%, 30%, 50%, 70% and 100% to show most appropriately the visual form of the image concept, including tonal components.

5. Two color tint images
Areas of uniformly flat densities of red and blue pigment in percentages chosen from 0%, 10%, 30%, 50%, 70% and 100% to show most appropriately the visual form of the image concept, including tonal components.

6. Black and white line images
Lines or areas of maximum density (100%) of black pigment to show most appropriately the visual form of the image concept, excluding tonal components.

7. Two color line images
Lines or areas of maximum density (100%) of red and blue pigment to show most appropriately the visual form of the image concept, excluding tonal components.

1. Black and white and color

There are two main color theories. One is the additive color theory which is concerned with light; the other is the subtractive color theory which is concerned with pigment. The way in which black and color are referred to in these theories is not synonymous with printing terminology. The difference needs to be explained, since in this thesis the modes of visual representation are all applicable to a printed medium.

Black and white and color are used in the modes of visual representation in the following ways.

Black pigments used in the images are either silver halides in transparent photographic emulsion or black transfer tones applied mechanically (letratone), ink and paint.

According to the subtractive color theory, black pigment will absorb all of the total light spectrum and reflect no light onto the cones in the retina of the eye, giving a physiological impression of black, hence black is the total absence of color.

White in the images is the surface to which no black pigments are applied. According to the subtractive color theory, white will reflect all of the total light spectrum onto the cones in the retina of the eye, giving a physiological impression of white.

Color pigments used in the images are colored pigments in transparent photographic emulsion or color transfer tones applied mechanically (pantone) and paint. According to the subtractive color theory, color pigments reflect selective portions of the total light spectrum onto the cones in the retina.

In printing terminology, black and white printing is sometimes called one color printing when it should be referred to as a single run of ink, if it means black ink onto white paper.

Tint and line images are as an alternative drawn in red and blue. In printing, this is often called two color printing. Two colors may overprint each other to produce the physiological effect of a third color without a third run of ink.

The two colours, red and blue, are taken from Eysenck's Universal Scale of Colour Preferences (1941) in which red and blue are placed 1 and 2.

2. Tone drawings

As implied in the definitions of modes of visual representation, tone drawings are not meant to be imitations of the photographs, but a most appropriate representation of the visual form of the image concept.

3. Tint images

The conventional printing term for a tint is a tone, which in this thesis does not clearly distinguish it from the term 'half tone'. In this thesis, a flat percentage area is called a tint, in order to distinguish one specific type of tone.

4. Line images

In printing terminology, the definition of lines or areas of maximum density (100%) of pigment applies. This appears to be in agreement with my thesis definition.

However, there are a number of line images that technically fall under this definition (e.g., cross hatch and stipple) when the effect produced is that of a tone. This is a physiological effect. Some lines that are too small to be seen by the naked eye appear fused when closely grouped. In terms of image concept, tone gradation is not a critical attribute of a line image.

3a. Image concept titles 24

1. An arrangement of elements

2. An arrangement of elements

3. Comparison of size

4. Movement

5a. Depth

5b. Depth

6. Face

7. Open structure

8. Enclosing structure

9. Transparent structure

10a. Geometric structure

10b. Geometric structure

	1
Image concept title	**An arrangement of elements**
Image subject	Plant
Written description of image concept	'An arrangement of elements forming a natural image shown complete'
Critical attribute	A selection of elements forming a group based on similarity
Category	Formal

	2
Image concept title	**An arrangement of elements**
Image subject	Plant parts forming the figure of a man
Written description of image concept	'An arrangement of elements forming an imaginary image composed of natural parts'
Critical attribute	A selection of elements forming a group based on similarity
Category	Formal

	3
Image concept title	**Comparison of size**
Image subject	Moth on leaf
Written description of image concept	'A juxtaposition of two dissimilar shapes showing relative rather than actual size'
Critical attribute	The familiarity of the sizes of the leaf and the moth
Category	Affective

	4
Image concept title	**Movement**
Image subject	Car on bridge
Written description of image concept	'A shape that appears in motion against some static background'
Critical attribute	The horizontal blur against vertical background elements
Category	Formal

	5a
Image concept title	**Depth**
Image subject	Four pillars of equal size in a corridor
Written description of image concept	'A space in which the area relationship and linear perspective of shapes indicates distance to the furthest point'
Critical attribute	Relative area relationship of pillars and perspective of ceiling lines
Category	Formal

	5b
Image concept title	**Depth**
Image subject	Mountains and river
Written description of image concept	'A space in which the area relationship and linear perspective of shapes indicates distance to the furthest point'
Critical attribute	Relative area relationship of mountains and river
Category	Formal

	6
Image concept title	**Face**
Image subject	Close up of features of face
Written description of image concept	'A few characteristic features forming a natural configuration, part of which is cut off by the image frame'
Critical attribute	Eyes, nostrils and mouth
Category	Affective

	7
Image concept title	**Open structure**
Image subject	Chair
Written description of image concept	'A functional construction of four bars in a vertical position and two bars and one flat surface in a horizontal position'
Critical attribute	The construction of elements, some of which are joined, some of which are not
Category	Formal

	8
Image concept title	**Enclosing structure**
Image subject	Part of a building
Written description of image concept	'An arrangement of shapes showing a solid three dimensional exterior indicating enclosed space'
Critical attribute	The angle of the building, showing three dimensions to enclose space.
Category	Formal

9

Image concept title	**Transparent structure**
Image subject	Greenhouse
Written description of image concept	'An arrangement of shapes showing a three dimensional external structure through which interior elements of a different nature can be seen'
Critical attribute	Some of the internal elements are interrupted by the frame.
Category	Formal

10a

Image concept title	**Geometric structure**
Image subject	Hexagon made up of 61 smarties
Written description of image concept	'An arrangement of almost identical elements which together form an abstract shape'
Critical attribute	Position and color of elements
Category	Formal

10b

Image concept title	**Geometric structure**
Image subject	Hexagon made up of 61 smarties, with 55 smarties around the outside.
Written description of image concept	'An arrangement of almost identical elements which together form an abstract shape'
Critical attribute	Position and color of the elements
Category	Formal

Image concept title
Each of 10 image concept titles is derived from a passage (see page 46)

Image subject
Each image concept is represented by a realistic subject in an image. Since the test is concerned with comprehension and not personal preference, it is important that the image concept is recognized from the image. The subject in the image must correspond with the image concept but it is not the image concept itself.

Written description of image concept
The written description of the image concept describes the configuration of visual elements of the image concept. The written description refers to what the image structurally represents, not the subject of the image.

Critical attribute
The critical attribute of the essential configuration of visual elements is the attribute without which the image concept might not be recognized.

Category
Each image concept may be described in terms of one of three concept equivalence categories, i.e., affective, functional and formal categories.

This categorization is derived from 'A Study of Thinking' by J. S. Bruner, in which he describes three categories for classifying concepts (see page 40) Identity and equivalence classes depend upon the acceptance of attributes of objects as being critical. Whilst this categorization is not directly relevant to the test, it provides a basis for grouping the concepts in order to simplify the explanations of their function.

Three pretests were carried out for this thesis (see page 16)

1. The first test was to discover preferences for mode of representation. Twenty-five university-level students (16 male subjects and 9 female subjects) were used. All the subjects were given an open presentation of four sets of images displayed in groups on a wall. The image concepts chosen were: 1. 'An arrangement of elements', 4. 'Depth', 6. 'Open structure', 7. 'Enclosing structure'. Out of each group, the subjects were asked to select the image or images that best represented the concept, and put the seven modes in their order of preference. They were also asked to give a reason for their first choice.

Overall, the male subjects placed the modes of representation in the following order of preference.

1. Full color photographs
2. Black and white photographs
3. Black and white tint images
4. Two color tint images
5. Two color line images

The female subjects placed the modes of representation in the following order of preference.

1. Full color photographs
2. Black and white photographs
3. Two color tint images
4. Black and white tint images
5. Black and white line images
6. Two color line images

Color photographs were of a higher quality than the illustrations and drawings that were presented at this stage in this test. Some of the subjects chose a mode they liked anyway, for all concepts, despite the quality of the individual illustration.

All the subjects found this a hard test, since when presented with seven versions of the same image concept, they really did not know which they understood to be the best and therefore chose the one they preferred.

1
Arrangement of elements

Full color photograph	*Original content is best defined, subject is easily perceived. Color aids recognition and clarifies the image.*
Black and white photograph	*Equality of tones*
Two color line	*Shows simplicity in grouping similar forms*
Black line	*Clarifies relationships and information*

4
Depth

Full color photograph	*Shadows enhance depth and spatial relationships, produces strong linear perspective*
Black and white photograph	*Depth cues are concentrated by the tone and provide a realistic representation*
Black line	*Clarifies perspective and spatial relationships, enlarges space*
Tone drawing	*Shows both perspective and a measure of reality*

6
Open structure

Full color photograph	*Clearly represents three dimensions, opens the structure, shows space and background*
Black and white photograph	*Shows chair on ground, stresses openness, clarifies structure, shows all that is necessary*
Black and white tint image	*Shows structure without interfering background, sets structure in space with no horizon line*
Two color line	*Background enhances white color*
Black line image	*Clarifies structure, sets object in space*
Tone drawing	*Defines space and ground, illustrates dimensions and textures*

7
Enclosing structure

Full color photograph	*Three dimensional structure shown most clearly in contrast with the sky*
Black and white photograph	*Three dimensional structure clearly shown, impression of weight, texture defines space*
Two color tint	*Shows structure, assists defining arrangement*
Two color line	*Angle of building clearly shown*
Black line	*Flatest, clearest representation*

2. The second test was to discover comprehension of modes of representation. Seven university-level students were used. Each subject was assigned to one of the seven modes of visual representation of four image concepts. They were told that each image represented a concept and were asked to select from two written descriptions of concepts the one that each image best represented.

The modes of representation were chosen correctly on the following number of occasions:

Full color photograph	4
Color tint images	4
Tone drawings	4
Black and white half tone	3
Black line	3
Two color line	3
Black and white tint	3

This was an easier test than the first, but some of the descriptions were confused. This may have been due to the descriptions of the image concept rather than the mode.

3. The third test was to discover comprehension of modes of representation. Ten university-level students were given an open presentation of 35 images together. They were asked to examine each image separately and record on their score sheet how well each image was represented by five possible descriptions. They were asked to give a mark for each description for every image. By adding all the scores together for each mode, the following scores were produced:

Full color photograph	220
Black and white photograph	203
Black and white tint images	199
Black line images	187
Two color tint images	171
Tone drawings	151

This is not an easy test, although it is used in a larger version in the final test of the series. The fact that the images were presented in a random sequence made it difficult to judge how well an image represented a concept, since the subjects wanted to compare the versions against each other rather than against the written description.

Procedure

Eighty-four images representing 10 image concepts in seven modes of visual representation are displayed together in an open presentation in a random sequence on a wall or walls. The images are numbered individually from 1 to 84.

Each subject is given a score sheet in which there are listed 10 written descriptions of 10 image concepts (see list, pages 25 - 28)

The subjects are asked to look at each image and after an overview of all images and descriptions, record which images represent which descriptions in their numbered score sheets.

They are asked to select three out of 10 possible descriptions for each image and rank order their appropriateness by assigning a score out of 7 for each. They are asked to cross out those they consider completely inappropriate descriptions. In order to make it a random presentation, the score sheets do not all start at image 1. The test does not have to be done in consecutive order (see page 17)

Scoring

Scoring is conducted on the basis of adding together all the scores for each mode of visual representation. The mode that receives the highest score may be understood to have been recognized most often as representative of the image concept and therefore the most efficient in terms of preference and comprehension.

Subjects

A minimum of 35 subjects would be required; in this case they would form a random sample of students/staff of university level.

Constants

10 sets of images representing 10 image concepts (see page 29)

Variables

Each image concept is carried out in seven defined modes of visual representation. Seven modes of visual representation of a concept form one set of images (see page 20)

This thesis is by no means a full investigation of the working hypothesis.

The emphasis has been placed on meeting the specific objectives of designing the test and not on achieving conclusive results.

The results of the pretests indicated that color photographs both for preference and comprehension were chosen as the best mode of representation.

As explained under problems encountered, the uneven quality of illustrations may have had an effect on the test results. The photographs are of a higher quality than the drawings; the drawings are in some cases more photographic than representative of the configuration of visual elements of the image concept.

Most of the images completed for the present test were more successful than the ones for the pretests. The written descriptions also changed in between the final and pretests to make them closer to the essential configuration of visual elements of the image concept.

In order to produce the same number of images more successfully in future, a team with a variety of skills would probably be required. Each mode could be assigned to a person with appropriate skills .

Human communication

Our existence depends on communication.
Human communication refers to all those means by which ideas, information and attitudes are conveyed from one human mind to another, and it incorporates fundamental human characteristics. Communication is a dynamic process and serves the purpose of mediating information and adjusting understandings between individuals and groups. Meaning can only exist through reference to common aspects of our lives minds and language. Genuine communication may only take place when there is a shared basis of understanding among participants.

Bruner, J.S.
Towards a Theory of Instruction
p.134

For communication systems to be effective, they must produce internal counterparts in their user's minds. (Bruner)

We live and communicate in spite of our ignorance concerning the many processes involved. Information theory may provide an objective basis for improving communication.

In 1948, Claude E.Shannon published 'The Mathematical Theory of Communication ' in the Bell System Technical Journal.

Shannon's communication or information theory reduces any complex situation to a few elements. It provides a way of measuring the commodity that is being transmitted.

Bit

A bit is the measure of uncertainty between 'yes' and 'no' when both are equally likely. Anything that resolves or eliminates uncertainty may be regarded as information.

Sample space

The processes of concept formation and perception are active searches to find distinguishing features in the stimuli that reach our senses. Fundamental to this search is the presence of uncertainty. In Information theory, a situation in which some event is to be selected from a set of alternative events is termed a sample space.

Information

'Information' or items of knowledge can be described in terms of what is new in state Y in relation to previous state X. This involves the transmission of information from one 'sample space' to another. The amount by which uncertainty about Y

is reduced on receipt of a particular signal belonging to X determines the amount of information transmitted. In this thesis, information is the image concept.

Code

A code is the system or structure imposed upon information which permits information to be transmitted. The manner in which a statement is codified determines its form. In this thesis, a code is a mode of visual representation. The structure of modes of visual representation impose their limits on visual communication.

Channel

A channel is the physical means of communication. Channels have a maximum information transmission capacity. If the capacity of a channel is exceeded, information will be lost. In this thesis, a channel is an image.

Medium

The channel and the code together comprise the medium. Certain forms of modes of visual representation and the ability of certain channels to transmit specific kinds of codes can enhance or be detrimental to the message content. In this thesis, the medium comprises the mode of representation, the image and the board on which the image is placed.

Noise

In information theory, anything that increases uncertainty or interferes with the signal is 'noise'.
In some cases, the code may be so dominent as to interfere with the actual message content. The code may then be a source of noise in that it is a signal that the sender does not want to transmit. Messages can be distorted in transmission and the noise of a code can obliterate them partially or entirely.
All channels of information are subject to some degree of noise. To increase the efficiency of communication, we have to find ways of reducing noise.
In this thesis, noise is any visual attribute that may interfere with recognition of the image concept.

Redundancy

Many modes of communication contain considerable redundancy. Redundancy refers to the fact that certain symbols in some contexts carry little new information. When we speak, our language is full of redundancies. We use more symbols than are absolutely necessary . If language contained no redundancies however, we would need to perceive every sound accurately. Although redundancy slows down the process of transmitting information, it reduces the probability of error in perception. In this thesis, redundancy refers to any of the visual attributes that may be superfluous to the understanding of the image concept.

Concept formation

The work of Jean Piaget (1928) demonstrated the development of human thinking in children, in which perception plays a part. Piaget felt that perception could be compared and contrasted with intelligence. He showed that the biological concept of adaptation indicates an interplay of two processes, assimilation and accommodation.

Assimilation occurs when a child acts on an environmental object according to his previous experience with some similar object. In accomodation, new activities are incorporated into the child's repertoire in response to the demands of the environment.

Piaget showed that until the age of eleven, children are dominated by their perceptions, responding to what attracts their immediate attention. He sees cognitive behaviour and growth in children as a slow process, during which they are first dependent on action, then on perception and gradually become more able to rely on thought. They learn to organise their experiences, past, present and future and gain enrichment of experience.

Intellectual activity begins with physical actions upon the environment. These actions become incorporated into a mental structure.

In 'A Theory of Instruction' (1966) J.S . Bruner says:

> *Instruction is an effort to assist or shape growth. Growth depends upon internalizing events into a structure or storage system that corresponds to the environment. Predictions and extrapolations may be made from a stored model of the world*

Bruner, J.S.
Towards a Theory of Instruction
p.1

According to Bruner, individuals possess three parallel systems for processing information, which are enactive, iconic and symbolic.

> *Visual representation is governed by perceptual principles and depends upon visual or other sensory organisation. In growth, some form of image or schema formation comes automatically. How the nervous system converts a sequence of responses into an image or schema is simply not understood.*

Representation in words or language. The use of symbolic language as an instrument of thinking is important. Words gradually become to be used for things not present. Representations of the world of possible experience may be constructed. Language provides the means of getting free of immediate experience as the sole basis of judgement. (Bruner)

Bruner, J.S.
Towards a Theory of Instruction
p.20

Bruner suggests that all mental growth depends upon growth from outside in and of translating experience into higher-order systems of ordering.

In 'A Study of Thinking' (1955) Bruner defines concept formation as the process by means of which we discover some common characteristic of a series of objects or events, which enables us to set them apart from other objects or events.

The task of isolating and using a concept is deeply imbedded in cognitive life. One learns concepts by the association of external stimuli with internal mediating stimuli (Bruner)

Concepts are modes of ordering or dealing with sensory data. A concept is a set of abstract ideas, generally applied to particular instances. Concepts enable us to organise and interpret information that we receive via our senses. When we encounter new information, we relate it to past experience by the use of concepts. We are able to categorise, or classify experience;

The categories in terms of which man sorts out and responds to the world about him may reflect the culture into which he is born. To categorize is to render discriminably different things equivalent: to group objects people and events into classes and to respond to them in terms of their class membership rather than their uniqueness.

Bruner, J.S.
A Study of Thinking
p.129

By identifying and categorizing as equivalent discriminably different events, the organism reduces the complexity of its environment. This involves the use of defining attributes in terms of which groupings can be made. (Bruner)

Defining attribute

A defining attribute is an inherent characteristic or discriminable feature of an event.

Critical attribute

A critical attribute is an inherent characteristic or discriminable feature of an event whose absence alters the likelihood of an event being categorized in a certain way.

The establishment of a category based on a set of attributes reduces the necessity of constant learning.

Identity categorization may be defined as the classing of a variety of stimuli as forms of the same thing. There is a presence of essential quality.

Equivalence categorization may be defined as the classing of a set of discriminably different things as the same kind of thing or amounting to the same thing. Both identity and equivalence classes depend upon the acceptance of attributes of objects as being critical or relevant.

According to Bruner, there are three broad classes of equivalence categories, each distinguished by the kind of defining response involved. They may be called affective, functional and formal categories. They provide a basis for grouping concepts, in order to simplify the explanations of their functions.

Categorization at the perceptual level consists of the process of identification or the act of referring a stimulus input, because of its defining attributes to a certain class. At the perceptual level, the relevant attributes are immediately given by which we judge the categorial identity of an object.

Perception

Perceptual philosophies have been divided into nativism and empiricism, those which hold that we are born with some knowledge of the world and those which claim that all knowledge is derived from sensory experience. Some resolution of their views has occured.

Eighteenth century empiricist philosophers regarded perception as a passive process. Gestalt writers tended to say that there are pictures inside the brain. They thought of perception in terms of modifications of electrical fields of the brain, these fields copying the forms of perceived objects.

They particularly stressed the tendency for the brain to group things into simple units.

Perception may now be thought of as an active building and testing of hypotheses which are tied to motivational processes which change to some extent throughout life. Perceptual hypotheses sometimes differ from our most firmly held intellectual beliefs and are non adaptive. However, the ability to recognise objects which direct behaviour are as important to the survival of a creature as is its structure. Structure developes by natural selection and the same can be said to be true for perceptual mechanisms, although perception is much more flexible and adaptive than body structure.

In the evolution of life, senses first monitored physical conditions. Touch, taste and temperature senses developed before specialized eyes. In 'New Theory of Vision' (1709) Berkeley reached the conclusion that all our knowledge of space and solidity must be acquired through the enactive sense of touch and movement. Philosophers and psychologists from Berkeley's time on have continued to stress the importance of touch for our confidence in a solid permanent world.

Touch is limited. It encounters only objects in physical contact with the organism. It is not a spatial sense. The visual sense first developed as a response to moving shadows on the surface of the skin and by later evolutionary elaborations the mechanisms for responding to form, size, and colour arose.

Well developed visual systems may give warning by locating distant objects. Brains developed integrally with senses capable of providing advance information. The eye itself is not only a sense organ but a projection of the brain.

The perceptual identifications of objects involves knowledge of objects derived from previous experience, this experience is not limited to vision, but may include other senses.

Given the slenderest clues to the nature of events, we identify them and act not so much according to what is directly sensed but to what is believed, in an effort to categorize information.

> *Visual perception in the sense of behaving appropriately to non-visual as well as directly to visual features of objects occurs in creatures far removed from man down the evolutionary scale. This seems to imply that some kind of internal map is built up during learning and used for guiding behaviour (Gregory)*

Gregory, R.L.
The Intelligent Eye
p.31

> *Perceiving is the having or achieving knowledge about the world. Perception involves the analysis and synthesis within the nervous system of information originating in external events (Gibson)*

Gibson, J.J.
The senses considered as Perceptual Systems

Perception is not determined simply by the stimulus patterns, rather it is the dynamic searching for the best interpretation of the available data, according to stored representations in memory.

The data is immediate sensory information and stored knowledge of other characteristics of objects.

In our perceptions we are self centred. We search the world for things which might concern us directly.

> *Perception involves a continuously active process of scanning, fixating, constructing scenes from parts of scenes, interpreting, remembering. We may suppose that perception involves betting on the most probable interpretation of sensory data in terms of the world of objects.*
> *(Gregory)*

Gregory, R.I
Eye and Brain
p.36

If stored information is used, behaviour can continue in the temporary absence of relevant information. An effective seeing system uses current sensory information to select stored hypotheses, representing important features of the external world of objects.

It is clear that it is uneconomical to store an independent model of each object, but better to store typical characteristics of objects and to use current sensory information to adjust the selected model to fit the prevailing situation.

Perceptual development and concept formation are concerned with perceiving events in terms of higher order sets of features.

> *Perhaps the most basic thing that can be said about human memory is that unless detail is placed into a structural pattern it is rapidly forgotten. Detailed material is conserved in memory by the use of simplified ways of representing it. (Bruner)*

Bruner, J.S.
A Study of Thinking
p.31

Since our capacity to remember to some extent determines our intelligence, it is important that information is organised to make the most efficient use of the memory available to us. We cannot think simultaneously about everything we know. Our memories may then be limited by the number of symbolic representations we must learn, rather than the amount of information that symbols represent.

The value of the image in communication has been indicated by Ralph Norman Haber

> *Visual perception is concerned with remembering what we have seen as with the act of seeing itself. The capacity of memory for pictures may be unlimited; recognition is based upon some type of representation in memory that is maintained without labels, words or names.*

Haber, R.N
How we remember what we see
p. 34

What we have seen may stimulate recall more effectively than impulses produced by other senses. It is possible that perceiving involves a memory that is not representational but schematic. During a series of fixations, a schema of an image is synthesised using information from each successive fixation to add detail or extend the construction.

Although the memory involved in visual synthesis cannot consist simply of stored retinal images, recent experiments indicate that storage of this kind does exist under certain circumstances. After a momentary exposure to an image, the viewer preserves an image of the input pattern for a fraction of a second.

The Visual Image

Signs

In visual representation, signs stand for objects of the visible world. Signs are designators. They refer to something without reflecting any of its visual characteristics.
Signs are used for reasons other than portrayal, so that without having any specific references, they maintain a functional generality.

> *Signs may refer to present experience, but their significance relates to future behaviour. The sign has anticipating value, making it possible to get ahead of events*
> *(Aranguren)*

Aranguren, J.L.
Human Communication
p.5

Signs have no message content and must be interpreted. The significance of a sign relies on the context in which it is experienced or learned.

In communication, meaning is what connects the sign with its referent. Meaning can be identified in terms of the response or behaviour of the interpreter. The behaviour evoked by a sign is not in general identical with the behaviour that would have been evoked by its referent.

Symbols

Symbols have evolved out of signs or designators and operate to increase the efficiency of signalling.
Symbols may be used to extend our perceptual models of the world to cover cases beyond the range of direct experience.

The symbolic image represents ideas by means of a relationship, association, convention or resemblance. The meaning of a symbol is established through its agreed upon use within a group. Symbols become meaningful when the perceiver projects meanings into them and responds accordingly.

Most input processed by the sensory system can serve as a symbol in symbolic function, if properly presented.

Symbols need not have the shape of the subject to which they refer, but there are constraints in the evolution of symbolic representation which confine their structure within certain limits of recognition.

If organisms may manipulate symbols rather than signs, operations have not to be acted out, they can be learned.

Iconic representation

An iconic representation is a conventional simple representation whose reference to an original is or seems familiar even if the viewer has never seen it before. Iconic representations are associated with a subject through understanding, which may be derived from other sources.

Abstract representation

In this thesis, an abstract image is a coherent configuration of intrinsic or essential visual elements.
Abstraction is mainly used to mean the reduction of information to essential defining attributes.

If a viewer does not have to be given all the attributes of a referent in order to understand it, it may be unnecessary to give them all; a danger of low fidelity may be vagueness or nonspecificity. Skilful abstraction may clarify an amount of information and bring out recessive information.

In terms of information theory, a simplified or selective code may eliminate noise signals which are inappropriate for the recognition of important information.

In perception, selective emphasis may clarify the perception of a piece of information. Gestalt psychology indicated that perception may be triggered through incomplete visual patterns. This is termed schematic perception, which is built up from elemental structural features of objects.

Ten image concepts used in this thesis are taken from the following passages chosen from 'A Visual Syntax', part of the thesis 'An Introduction to Graphic Communication' compiled by Greg Prygrocki.

Image concepts 1 and 2 An arrangement of elements

Human beings gain knowledge through direct perception of their environment and through indirect perception using communication by signs. The visual image is a sign, and as such, mediates our knowledge of the world. The meaning of an image, its recognized significance by a viewer, is largely based on the organization and relationship of its component elements, that is, its form. Form is the perceptual carrier of meaning. A visual image is an 'idea in form'.

In verbal language, the structure of the sentence, the relationships of the words, will help determine its effectiveness as a communication. In considering images as visual communication, there are no equivalent structural rules, other than those of perceptual organization.

The Gestalt school of psychology was primarily concerned with aspects of organization with which the term 'Gestalt' is practically synonymous. According to the theories of Gestalt psychology, the fundamental unit of perception os not a single stimulus, but rather patterns of stimuli, each consisting of a collection of elements in a particular arrangement. Perception is based on the total configuration of the outside world as it is interpreted by the individual. It is therefore dependent upon the elements as well as their context, that is, their relationship to one another within the visual field.

Image concept 3 Comparison of size

Our interpretation of the size of material objects depends upon the nature of the context in which they are perceived.

Image concept 4 Movement

Our interpretation of the movement of material objects depends upon the nature of the context in which they are perceived.

Image concept 5 Depth

Our interpretation of the depth and distance of material objects depends upon the nature of the context in which they are perceived.

Attraction

No stimulus is seen irrespective of its surroundings. Beyond relative size (scale) and position of elements in the visual field, there exists a structure of perceptual 'forces'. Seeing something means assigning it a location within that structure.

If a circle is placed within a square, so that its centre is close to but does not coincide with the centre of the square, the circle is seen as being attracted to the centre of the square so that their centres coincide. If the circle is placed towards the border of one edge of the square, it may tend to be attracted to that edge. If the circle is placed in various positions within the square it may be found that at certain locations it appears stable, in dynamic equilibrium with the square, and at other locations it experiences 'pulls' in definite directions, or its position may be unclear and wavering.

Image concept 6 Face

Wherever an element is located in the visual field, it will be affected by the structural forces existing in that field.

Psychologically, these forces exist for everyone in every perception and are as real as the objects themselves. Visual forces act as the physicist's vectors, for they have a point of attack, an intensity and a direction, and therefore follow the laws of physical forces.

As with physical forces, their properties are determined by the size, weight, mass or relative position, etc. of the elements concerned, and thus can be balanced in a visually analogous manner.

Perceptual forces create the structure that enables us to see objects in a myriad of visual stimuli. It is the means through which we are able to integrate stimuli.

Seeing means grasping a few outstanding features of the object . . . a few simple elements are readily accepted as a 'face', not only by civilized Westerners, who may be suspected of having agreed among each other on such 'sign language', but also by babies, savages and animals. Vision involves the solution of a problem - namely the creation of an organized whole.

Image concept 7 Open structure

Overall structural features are the primary data of perception. 'Chairness' is not a concept resulting from intellectual abstraction, but is the direct result of a more fundamental perceptual experience than the recording of individual details. Thus all the variety and styles of chairs are recognized as such because they all have the underlying structural features of a 'chair'. A child will see a chair before he can recognize it as a particular style of chair distinguishable from others.

Image concept 8 Enclosing structure

Structure refers to the distribution of materials in space. The structures of objects form shapes and involve such spatial aspects as the boundaries of masses by surfaces.

Image concept 9 Transparent structure

Structure refers to the distribution of materials in space. The structures of objects form shapes and involve such spatial aspects as the boundaries of surfaces by borders such as lines.

Image concept 10 Geometric structure

This forms a basic law of visual perception which asserts that any stimulus pattern tends to be seen in such a way that the resulting structure is as simple as the given conditions permit. In a relative sense, a thing has simplicity when it organizes complex material with the smallest possible number of structural features.

The perceptual result of any stimulus pattern is determined by the structure of the stimulus in its interaction with the striving for the greatest simplicity. That is, the perceived pattern will be the one that combines the conditions of the retinal stimulus and the organizational tendencies of the brain in the simplest possible structure.

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Appendix

Preliminary test of thesis

Sally Don
January 12 1976

In this short test you are presented with four groups of images. Out of each group of images, you are asked to select the image or images that best represent to you , a particular concept.

On these sheets, you are given the name of four concepts and an accurate definition or description of each one. Please examine each group of images carefully and place the images, by letter, in your order of preference, most appropriate image first, least appropriate last.

For each group please also give a short reason for your first choice.

Take as long as you like; there are no right or wrong answers.

Concept 1

An Arrangment of elements

A collection of elements which, because of their relationship to each other in the first arrangment form an image with a certain meaning and because of their changed relationship in the second arrangment, form an image with a different meaning.

Order of preference

Choice 1

2

3

4

5

6

7

Reason for first choice:

Concept 2

Depth

A space in which the linear relationship of elements contained displays the distance from the nearest to the furthest element.

Order of preference

Choice 1

2

3

4

5

6

7

Reason for first choice

Concept 3

A three dimensional arrangment of elements in a definite pattern of organization which is not enclosed or confined and is accessible on nearly all sides.

Order of preference:

Choice 1

2

3

4

5

6

7

Reason for first choice:

Concept 4

A three dimensional arrangment of elements in a definite pattern of organization which has no internal space and no external opening.

Order of preference

Choice 1

2

3

4

5

6

7

Reason for first choice:

Preliminary test of thesis

Sally Don
January 13, 1976

In this short test, you are presented with a group of four images. Each image represents a concept. You are asked to select from two descriptions of concepts, the one that is best represented to you by the image.

On these sheets, you are given two possible descriptions for each image.

Take as long as you like to match the concept to the image.

Image 1.

Concept A

A collection of elements which form a natural configuration because of their position.

Concept B

A collection of elements which, in the first arrangment form one image through a natural relationship, and in the second arrangment form another image through an unnatural relationship.

Image 2

Concept A

A space in which the area relationship and linear perspective of elements contained indicates the distance from the nearest to the furthest element.

Concept B

An element that appears in motion against a static background.

Image 3

Concept A

A three dimensional arrangment of elements forming an external structure through which internal elements can be seen.

Concept B

An arrangment of four elements in a vertical plane and three in a horizontal plane. The largest horizontal element creates a flat surface area between the four vertical elements.

Image 4

Concept A

A three dimensional arrangment of elements forming a solid exterior containing an invisible internal space with no visible external opening.

Concept B

Two elements juxtaposed with the smaller on top of the larger so that the difference in size between them is clearly apparent.

Preliminary test of thesis

Sally Don
January 20 1976

There are many different ways to represent ideas, both verbally and visually.

In this test we are concerned with matching verbal with visual representations.

You are presented with thirty-five images. Please look at each image seperately and record on the appropriate sheet of paper following this introductory sheet, both which verbal idea is represented by the image and how well it is represented by it, on the scale provided, from 1 to 7.

(If you think the image fits the description exactly circle the 7, not so well 6, 5, 4, and so on.) Please give a mark for each image. Spend as long as you like on each one; there are no right or wrong answers.

Image

1 2 3 4 5 6 7 An arrangment of elements which forms a natural image

1 2 3 4 5 6 7 An arrangment of elements which forms an imaginary image

1 2 3 4 5 6 7 A space in which the area relationship and linear perspective of elements contained indicates distance from the nearest to the furthest element

1 2 3 4 5 6 7 A construction of four bars in a vertical position and two bars and one flat surface in a horizontal position

1 2 3 4 5 6 7 A three dimensional arrangment of elements showing a solid exterior

The image in communication

There are many different ways to represent ideas.

This examination is concerned with relating visual representations with verbal descriptions to find appropriate ways to represent visual concepts.

You are presented with 84 images.

Please look at each image and record on the appropriate sheet of paper following this introductory sheet how well each image represents a description.

For this purpose, use the scale provided from 7 to 1. If you think the image matches a description very well circle the 7, not so well 6, 5, 4, and so on.

Please record a mark for each description for every image. Take as long as you like to look at all the images.

1	An arrangement of elements which forms a natural image	7 6 5 4 3 2 1
2	An arrangement of elements which forms an imaginary image	7 6 5 4 3 2 1
3	A relationship between two elements which shows their size in proportion to each other, but not their actual size in reality.	7 6 5 4 3 2 1
4	An element which appears in motion against a static background	7 6 5 4 3 2 1
5	A space in which the area relationship and linear perspective of elements contained indicates distance from the nearest to the furthest element.	7 6 5 4 3 2 1
6	A construction of four bars in a vertical position and two bars and one flat surface in a horizontal position.	7 6 5 4 3 2 1
7	A few elements which form a natural configuration because of their position.	7 6 5 4 3 2 1
8	A three dimensional arrangement of elements showing a a solid exterior	7 6 5 4 3 2 1
9	A three dimensional arrangement of elements showing an external structure through which the internal elements can be seen	7 6 5 4 3 2 1
10	An arrangement of elements which form a clear shape	7 6 5 4 3 2 1

The Image in Communication

Explanation of purpose

This test is to investigate whether static modes of visual representation affect comprehension of concepts.

There are 84 numbered images, specially produced for this test.

In total, the images represent 10 concepts, each one in 7 modes of representation.

For this test, each image concept has one matching verbal description in the attached score sheets. In order to test comprehension of the concept represented by each image rather than personal preference for any particular mode, it seems necessary to ask for verbal descriptions of concepts to be related to pictorial concepts. For the same reason the images have been displayed in random order.

Procedures

Please look at each image and after an overview of all images and descriptions, record which images represent which description(s)

Select 3 out of 10 possible descriptions for each image and rank order their appropriateness by entering ~~circling~~ a score out of 7 for each.
For example, for image 5, if you consider descriptions 2 /6/9 are possible choices , you might mark the most appropriate 7 for being certain, 5 if doubtful and 2 unlikely.
Please cross out those you consider completely inappropriate descriptions.

This test does not have to be done in consecutive order.
Take as long as you like .
Thank you very much for your help.

Does your work or study involve regular use of visual concepts.?

Yes No Some

	1	2	3	4	5	6	7	8	9
An arrangement of elements forming a natural image shown complete.									
An arrangement of elements forming an imaginary image composed of natural parts.									
A juxtaposition of two dissimilar shapes showing relative rather than actual size.									
A shape which appears in motion against some static background.									
A space in which the area relationship and linear perspective of shapes indicates distance from the nearest to the furthest point.									
A few characteristic features forming a natural configuration part of which is cut off by the image frame.									
A functional construction of four bars in a vertical position and two bars and one flat surface in a horizontal position.									
An arrangement of shapes showing a solid three dimensional exterior, indicating enclosed space.									
An arrangement of shapes showing a three dimensional external structure through which interior elements of a different nature can be seen.									
An arrangement of almost identical elements which together form an abstract shape.									

example scoring

7 - certain
6 - most likely
5 - fairly certain
4 - possibly
3 - not very likely
2 - unlikely
1 - very unlikely

Overall comments on the test

Vita

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